RLH Industries, Inc.

16 Channel T1 Over Ethernet Multiplexer System

User Guide

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1. Important information

Intended Audience

This guide is intended for use by knowledgeable telco/network installation, operation and repair personnel. Every effort has been made to ensure the accuracy of the information in this guide is accurate. However, due to constant product improvement, specifications and information contained in this document are subject to change without notice.

Conventions

Symbols for notes, attention, and caution are used throughout this manual to provide readers with additional information, advice when special attention is needed, and caution to prevent injury or equipment damage.

Notes: Helpful information to assist in installation or operation.

Attention: information essential to installation or operation.

Caution: Important information that may result in equipment damage or injury if ignored.

General Safety Practices

The equipment discussed in this document may require tools designed for the purpose being described. RLH recommends that service personnel be familiar with the correct handling and use of any installation equipment used, and follow all safety precautions including the use of protective personal equipment as required.

Caution - Severe Shock Hazard

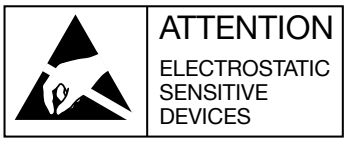
- Never install during a lightning storm or where unsafe high voltages are present.
- Active T1 lines carry high DC voltages up to 56V. Use caution when handling T1 wiring.

Warning

The intra-building port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intra-building port(s) of the equipment MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Special handling requirements

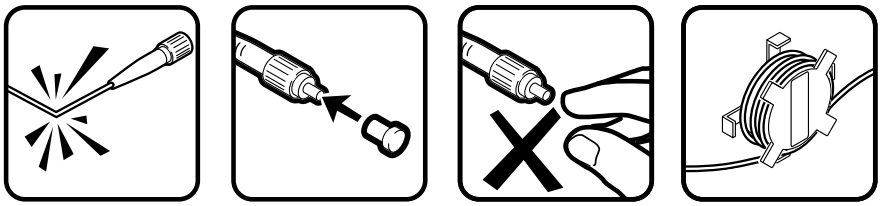
Be careful when handling electronic components



- This product contains static sensitive components.
- Do not open the enclosure, there are no user serviceable parts.
- Follow proper electrostatic discharge procedures.

This product utilizes circuitry that can be damaged by static electricity. Before installing, discharge static electricity on your body by physically making contact with earth ground. Failure to follow ESD precautions may cause damage to the unit and prevent proper operation.

Guidelines for handling terminated fiber cable



- Do not bend fiber cable sharply. Use gradual and smooth bends to avoid damaging glass fiber.
- Keep dust caps on fiber optic connectors at all times when disconnected.
- Do not remove dust caps from unused fiber.
- Keep fiber ends and fiber connectors clean and free from dust, dirt and debris. Contamination will cause signal loss.
- Do not touch fiber ends.
- Store excess fiber on housing spools or fiber spools at site

Acronyms

Commonly used acronyms and abbreviations

Acronym/Abbreviation	Description
B8ZS	Bipolar 8 Zero Substitution
AMI	Alternate Mark Inversion
CFJ	Copper Fiber Junction (also referred to as Demarc)
CO	Central Office
CPE	Customer Premises Equipment
Demarc	Location of RLH CO equipment and Telco connection
GPR	Ground Potential Rise
LED	Light Emitting Diode
Sub	Subscriber
NIU	Network Interface Unit
RX	Receive
TX	Transmit

Color abbreviations

Abbreviation	Color
BLU	Blue
GRN	Green
ORG	Orange
RED	Red
YEL	Yellow

2. General Information

Overview

Thank you for selecting the RLH 16 Channel T1/E1 over IP/Ethernet multiplexer. This modular multiplexer unit can be used to provide T1/E1 communication channels over Ethernet or IP networks.

The RLH 16 Channel T1/E1 multiplexer has many optional parameters, that can be modified by the user to suite different application requirements. Please read this guide carefully before installing the product.

It is well known that the T1/E1 signal comes from PCM technology which is TDM in nature. It transmits information in a constant bit rate of E1 2048kbit/s, TDM technology occupies fixed transmission bandwidth, with QoS features suitable for real-time applications such as voice and video. The QoS features include short and stable transmission delay, low jitter and wander, etc.

On the other hand, Ethernet is based on statistical multiplexing, transmitting and exchanging information in packets. It does not take up a fixed transmission bandwidth, which is good for achieving higher bandwidth utilization. But Ethernet technology does not provide adequate QoS for real time applications.

Until recently, voice and data were, and still are to a large extent, transported over two separate networks. But the requirement for both types of information to be carried over a unified network is growing rapidly. Packets over SONET/SDH techniques to integrate data into the TDM network have been around for many years. But for voice over packet based data networks, most of the efforts are spent on creating special equipment that specifically packets voice or video signals, such as equipment used for VoIP.

However, to take advantage of the data network, it is neither cost effective, nor necessary to replace all TDM based equipment with new packet based equipment. The RLH 16 Channel T1/E1 Mux can be used to emulate transparent T1/E1 channels over an Ethernet with adequate QoS, so that most existing T1/E1 based applications can be readily setup over Ethernet LANs and WANs. One such application is to build T1/E1 links with low cost wireless LAN bridges, replacing much more costly microwave radios.

RLH 16 Channel T1/E1 over GE Features

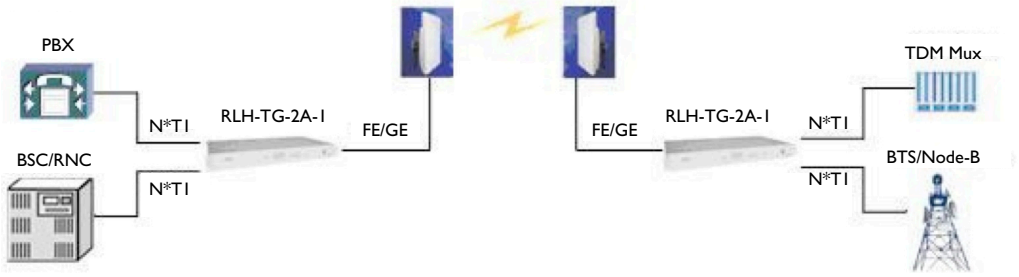
- Provide 16 channels of T1/E1 over 1 a single Ethernet port.
- Provide 5 GE electrical ports and 1 GE optical port, 6 GE ports serve as network uplinks or users ports, any of the 5 GE electrical ports may act as an NM port
- Support Ethernet spanning tree protocol which enables normal work and protection in ring and mesh topology, enabling very fast network protection
- User-friendly Web server supported for easy setup and maintenance, alarm log provided
- Support SNMP V1/V2 network management „Ethernet built-in layer 2 switch, support VLAN, comply with IEEE 802.3Q and 802.3ad, support 802.1P.
- Provide two pluggable T1/E1 cards, each card supports 8 channels
- Point to point and point to multipoint application
- Stable T1/E1 clock recovery, low jitter and wander
- Low processing delay for T1/E1 channels, high bandwidth usage efficiency

- Resistant to packet loss, with PCM frame synchronization protection.
- User definable encapsulation packet size for different applications.
- Supports Ethernet encapsulation and UDP/IP protocol encapsulation.
- Supports VLAN settings for T1/E1 service and in band VLAN management.
- Jitter buffer resists packet delay variation (PDV).
- Local Ethernet port throughput limiting, assuring T1/E1 QoS
- 120Ω balanced E1/T1 port, RJ-45 connector, support 75Ω unbalanced port through outside converting cable.
- Support cascade concatenate for more than 16 T1/E1 ports
- Software and hardware online upgrade
- Power supply redundancy

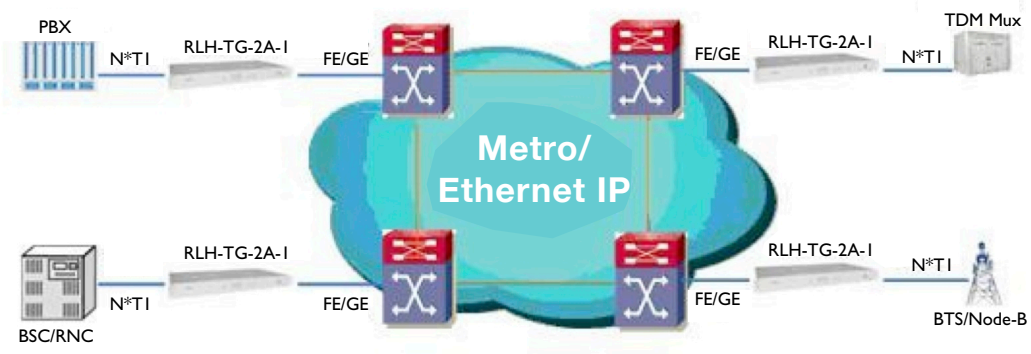
Applications

Network Integration

The 16 Ch. Mux. is used to transport up to 16 transparent E1/T1 channels over LAN or IP networks.



Typical Application in a Wireless Network



Typical Application in a Wired Network

In the diagrams above, a pair of RLH-TG-2A-1 multiplexers create transparent E1/T1 channels over the packet network, providing connections between the PBX and telephone exchange, or other terminal devices. At the same time, computers talk to each other through the local Ethernet ports. This configuration guarantees that the T1/E1 channels get higher priority over computer data for maximum QoS.

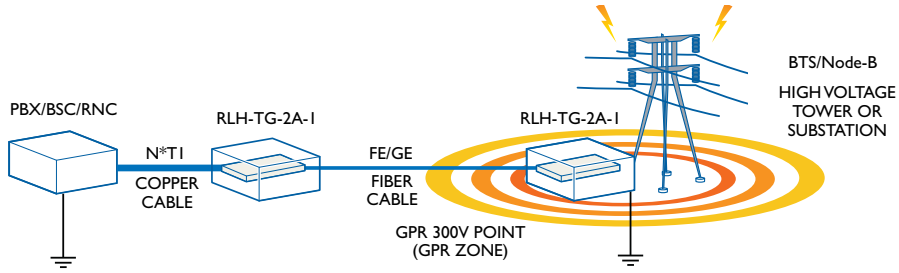
The most widely used application of the RLH-TG multiplexers is to set up point to point wireless T1/E1 links using low cost wireless LAN bridges. RLH-TG multiplexers can work with most LAN bridges on the market. It may be necessary to adjust different parameters such as packet size and packet jitter absorption buffer size for best operation for different LAN bridges.

Be aware that wireless LAN bridges have a very limited bandwidth. If Ethernet data is to be transferred at the same time, its traffic must be restricted. Otherwise it will affect the T1/E1 packets. Since the LAN bridges usually don't have adequate QoS mechanism to guarantee the T1/E1 priority, it is strongly recommended that the data traffic be routed through the device's local data port.

Warning

When connecting to a wireless LAN bridge, the uplink Ethernet cable often connects to the outdoor unit, posing danger to lightning strikes that can seriously damage the equipment. To protect the equipment as well as people, surge protection devices with good earth connection is strongly recommended. Poor earth connection may also hinder the operation of the Ethernet port, causing severe packet losses.

Fiber Optic Isolation



Typical HVP Application

Network equipment in high voltage areas can be at risk due to Ground Potential Rise (GPR). In this instance copper network cable referenced to a remote ground can become a path for high voltages during a ground fault. Use of all-dielectric fiber optic cable instead of copper completely eliminates the presence of a remote ground, which dramatically increases safety of personnel and reliability of equipment. By utilizing GE fiber optic cable, the RLH-TG multiplexer provides absolute electrical isolation between both ends of the network.

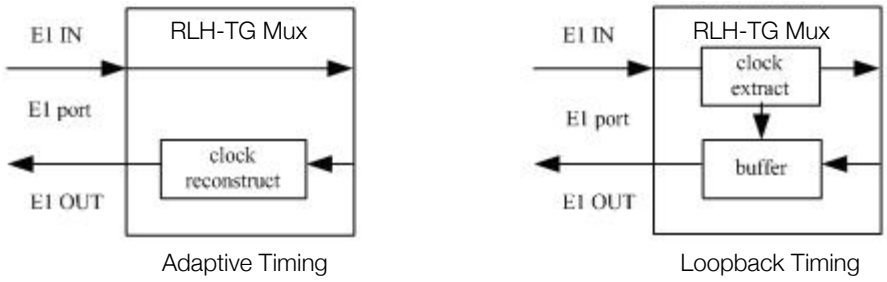
Copper twisted pair Ethernet is limited to 100m/328ft without extenders. Using fiber optic cable provides long distance service up to 80km/50mi. without any additional equipment. Optical fiber is also immune to EMI/RF interference, ground loops, and high voltage surges from lightning or ground faults, and is ideal in electrically noisy environments such as near large power sources, electrical motors, and radio communications equipment.

Timing modes

To emulate a clear E1/T1 channel over a packet network, the RLH-TG Mux not only conveys data stream content correctly from the source to the destination, but also passes timing. Packet networks do not provide such built-in timing transparency mechanism as TDM networks do. RLH-TG Mux uses its proprietary algorithm to reconstruct the E1/T1 clock at the destination. The recovered clock is of very high quality, with low jitter and wander. Typical frequency offset is within ±5ppm, and jitter is below 0.1UI. It can be adopted in most applications. This timing mode of rebuilding the E1 clock at the destination is called Adaptive Timing.

For applications where separate clock distribution network exists, another timing mode, Loop back Timing, may be used for maximum clock quality.

The two timing modes of RLH-TG Mux are shown below.

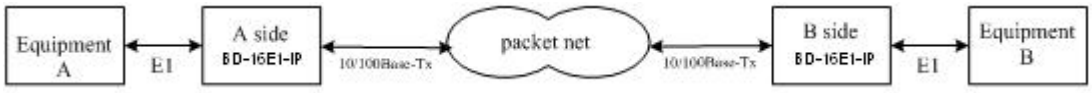


Timing Modes

Correct timing mode setting is important for smooth operation. In most cases, setting both units to adaptive timing mode is sufficient, but sometimes setting one unit to loop timing mode may work better. For example, setting the RLH-TG Mux unit connected with the clock master (such as local exchange) to loop back mode, and the other unit connected with the clock slave (such as PBX or remote module) to adaptive mode, is probably better than setting both to adaptive modes.

One typical error in telecom applications is to connect two communication devices that are both clock slaves. The RLH-TG Mux will not support such operation no mater how the timing modes are set.

Note: That the E1channel emulation takes several minutes to stabilize. During that period, clock drift may exceed the limit, errors and slips may occur.



Timing Mode Scheme Reference Diagram

Timing Mode Reference Table

Various timing setups for the two timing modes are shown in the table below. Note that setting both units to adaptive timing mode works well for all the conditions, although the other option may work better.

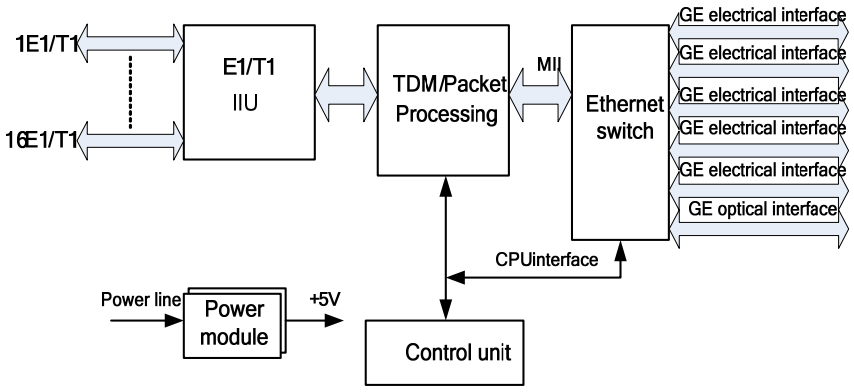
Equipment A Clock Mode	Equipment A Clock Mode	A Side RLH-TG Mux Timing Mode	B Side RLH-TG Mux Timing Mode	Notes
Master	Master	Loopback	Loopback	Equipment A & B clocks synchronous
		Adaptive	Adaptive	
Master	Master	Adaptive	Adaptive	Equipment A & B clocks plesiochronous
Master	Master	Loopback	Adaptive	
		Adaptive	Adaptive	
Slave	Master	Adaptive	Loopback	
		Adaptive	Adaptive	
Slave	Slave			Not allowed

Timing mode scheme reference table

2. System Architecture

Block Diagram

The internal functional structure of RLH-TG Mux is depicted below:



Functional Block Diagram

Functional Description

The core of RLH-TG Mux is the TDM/Packet processing unit. It truncates T1/E1 data stream, putting the data into Ethernet packet with or without IP headers. The packets are passed to the Ethernet switch unit via MII interface, and are sent out adaptive the uplink ports. Ethernet data from two local data port are also sent out through the uplink ports, but with lower priority than those packets containing T1/E1T1/E1 data.

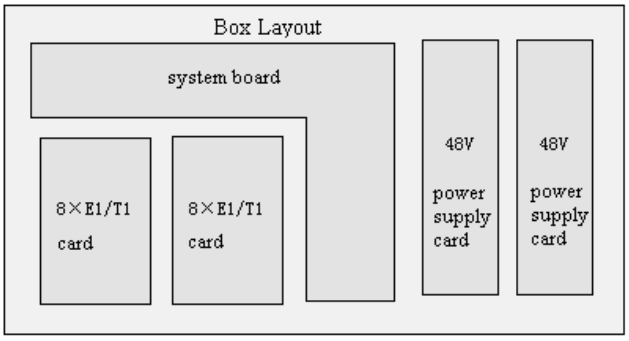
In the reverse direction, packets from the uplink ports are sorted at the switch unit. All but T1/E1 packets are passed to the local data ports. The packets containing T1/E1 data are sent to the TDM/ Packet processing unit for reassembling the original data stream, and recovering the T1/E1 clock which is the key element of the device. Very sophisticated algorithm is used to ensure that the reconstructed clock will meet the stringent requirement of TDM applications. The most important parameters are jitter, wander, and signal delay.

The control unit interfaces with the user through console port so that various operational parameters can be modified.

3. Components

Interior Layout

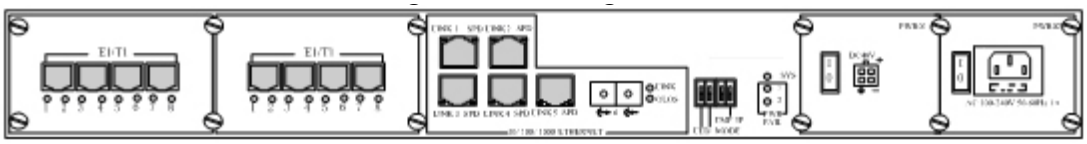
RLH-TG Mux adopt standard 1U box, which is composed by system board, power supply card and E1/ T1 card. System structure is shown below:



RLH-TG Mux system structure

Front panel

The T1/E1 modules and power supplies are accessible from the front panel. The modules are secured to the chassis with thumbscrews. To remove a module for servicing, unscrew the retainers, then insert two of the thumbscrews into the threaded holes in the front panel of the module you wish to remove. Screw the retainers in fully, and the desired module will be separated from the chassis far enough for easy removal by hand.



Front panel of RLH-TG Mux

LED's

LED indicator definitions are shown below.

Indicator	Color	LED	Description
SYS	GRN	ON	System configuring or failure
		Blinking	Normal system operation
		OFF	System failure
PWR FAIL	RED	ON	Power OFF/failure
		OFF	Power normal
LINK	GRN	ON	Optical Ethernet port connected to remote device
		OFF	Optical Ethernet port disconnected from remote device
OLOS	RED	ON	Optical Ethernet port receive failure
		OFF	Optical Ethernet port normal
LINK	GRN	ON	Ethernet TP port link OK
		Blinking	Ethernet TP port link OK with activity
		OFF	Ethernet TP port inactive
SPD	GRN	ON	Ethernet TP port speed is 1000M
		OFF	Ethernet TP port speed is 10/100M
T1 1 ~ 8	RED	ON/OFF	T1 interface indicator has various states depending on the DIP switch setting. See DIP switch table for additional information

Dip Switches

There are four DIP switches on the front panel. Refer to the DIP switch table below.

Label	Switch Number	Definition	Setting	LED	Description	Notes
LED_MODE	1	T1 packet loss alarm indicator	ON	ON	Ethernet interface cannot receive T1	Only when DIP switch 2 is set to OFF will this setting be valid.
				OFF	Ethernet interface has T1 packet loss	
				Blinking	Normal operation	
		T1 signal alarm status indicator	OFF	ON	T1 interface signal loss	
				OFF	T1 interface signal AIS alarm	
				Blinking	T1 interface signal loss	
	2	Remote equipment link status Indicator	ON	ON	Addressing remote MAC	
				OFF	Not addressing remote MAC	
		-	OFF	-	Set according to DIP switch No. 1	
NO_VLAN	3	Software VLAN	ON	-	Software VLAN Disabled	Use caution not to configure VLAN list incorrectly or management may be disabled
			OFF	-	Software VLAN set is valid	
TMP_IP	4	IP address setting	ON	-	Default IP address 192.192.192.192	
			OFF	-	Manually set IP address	

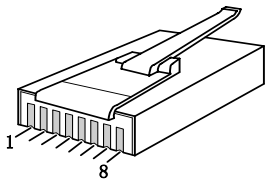
T1/E1Port Connections

There are 4 ports on each T1/E1 module, with each port carrying two T1/E1 channels. The T1/E1 connections are made using a breakout cable that splits the combined port on the modules into separate T1/E1 ports for easy connection to existing lines.

T1 adapter cables are included with each unit. The T1 port impedance is 120Ω for twisted pair cables and uses RJ45 connectors. Refer to the following pin assignment charts for wiring information on the breakout cables.

RJ-45 male pins chart

For connection to T1/E1 modules on both sides of the RLH-TG multiplexer.



RJ-45 male connector pin diagram

T1/E1 Line	RJ-45 Pin	T1 Signal	Twisted Pair	Recommended Color
A	1	IN –	Pair	Blue
	2	IN +		Blue White
	3	OUT –	Pair	Orange
	4	OUT +		Orange White
B	5	IN –	Pair	Green
	6	IN +		Green White
	7	OUT –	Pair	Brown
	8	OUT +		Brown White

RJ-45 female pins description for CO side units

Breakout connections to T1/E1 lines for the CO side.

T1/E1 Line	RJ-45 Pin	T1 Signal	Twisted Pair	Recommended Color
A	1	IN +	Pair	Blue White
	2	IN –		White
	4	OUT +	Pair	Orange White
	5	OUT –		Orange
B	1	IN +	Pair	Green White
	2	IN –		Green
	4	OUT +	Pair	Brown White
	5	OUT –		Brown

RJ-45 female pins description for Sub side units

Breakout connections to T1/E1 lines for the Sub side.

T1/E1 Line	RJ-45 Pin	T1 Signal	Twisted Pair	Recommended Color
A	4	IN +	Pair	Blue White
	5	IN –		White
	1	OUT +	Pair	Orange White
	2	OUT –		Orange
B	4	IN +	Pair	Green White
	5	IN –		Green
	1	OUT +	Pair	Brown White
	2	OUT –		Brown

Ethernet ports

There are five RJ45 Gigabit Ethernet electrical ports and one Gigabit optical port on the rear panel. Ethernet built-in layer-2 switch function. Supporting VLAN setting based on 802.1Q or 802.1ad Q in Q, and VLAN priority settings. The 6 GE ports could realize Ethernet switching function. Any one of them can be used for uplink or local data transport, or anyone of GE electrical port could be used for NMS port.

The GE electrical ports use RJ-45 sockets. Refer to the following Ethernet RJ-45 socket definition table.

Pin	1	2	3	4	5	6	7	8
Definition	TxD+	TxD-	RxD+	•	•	RxD-	•	•

Note: 10/100Base-Tx interface has HP auto-MDIX function and it can check the transmission and receiving sequence and make configuration. So both MDI and MDI-X interfaces are supported and both cross line and direct line can be selected.

The Ethernet optical port uses an SFP optical transceiver. Different transceivers are available to suit multimode, single mode, distance and fiber connector requirements. The input and output side of the transceivers are marked on the transceiver itself. Refer to the Ordering Information section for compatible transceivers available form RLH.

Power

Two power supplies are available, 115AC and 24~48VDC. There are two power supply slots on the chassis, and power supplies may be used in any combination. The power supplies are redundant, with automatic fall-over in the event one power supply fails or loses input. Power supply options are specified during ordering, and spares are available. See the Specifications section and Ordering Information section for additional information.

4. Installation

Prior to installation:

- Check for shipping damage
- Check the contents to ensure correct model and options
- Have a clean, dry, installation environment ready

Required for installation:

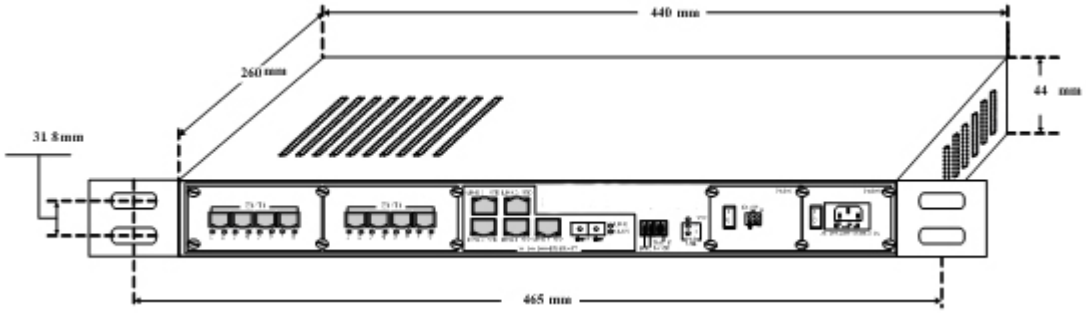
- 18V~74VDC or 100~240VAC local power source, depending on the power supplies used

Note: To maintain high voltage isolation, units at each end must be powered from separate isolated power sources.

Mechanical

RLH-TG Mux can be placed at the table top or mounted in a standard EIA 19" equipment rack. The unit requires 1RU of rack space for installation. When rack mounting the unit, install the 19" rack ears using the hardware supplied, and remove the 4 rubber feet (if installed). Rack mount hardware for quick installation is included.

Physical dimensions



Electrical

Power connections

The RLH-TG Mux consumes less than 10W of power.

Note: Check to make sure that the power switches on the power supplies are OFF before connecting power.

DC Power

Use the supplied DC power connector for the DC Power supply. Connect a local 24~48VDC power supply to the power connector. Make sure that the wire terminals are securely tightened. The ground contact is a chassis ground, and must be connected to prevent damage or injury during high voltage events.

The DC power supplies use a PPTC resettable fuse, no customer replacement is required.

Note: The power terminals are polarity sensitive. Attach the positive DC wire to the V+ terminal only.

AC Power

Connect a local 115~240VAC power supply to the power connector using the supplied AC power cord. The outlet must be grounded for safe operation. Turn OFF the power switch on the power supply before connecting or disconnecting the power.

Note that there is a 1A fuse in the AC socket which may be replaced when blown. Contact RLH for replacement fuses.

On the left corner of rear panel, a screw is used for connecting the chassis to the protective ground. Be sure to make this connection using a thick wire.

Warning: The system must be securely connected to a good protective ground for safety. All interconnected equipment must be grounded for maintaining signal integrity as well. Ground potential faults may also damage the interface ports.

E1/T1connections

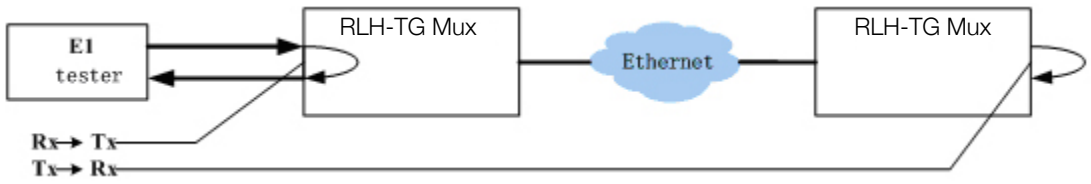
The E1/T1 ports on RLH-TG Mux are used for connecting to T1/E1 equipment such as the telephone exchange or PCM terminals.

Up to 16 E1/T1 ports are supported. T1/E1 port impedance are 120Ω for twisted pair cables or 75Ω for coax. The T1/E1-120Ω RJ45 sockets are default for ports.

The T1/E1-120Ω connection cable is made with RJ45 connectors and a breakout cable that is supplied with the unit. Refer to the RJ-45 T1/E1 pinout information in Section 3. Components.

When making up a cable assembly in the field, note that pin-1 and pin-2 should use the same twisted pair, so should pin-4 and pin-5. T1/E1 service can set the actual service quantity by NMS, set the exact T1/E1 channels received by local equipment from remote equipment, realizing T1/E1 service one point to multi-point unidirectional transmission function.

By NMS, T1/E1ports provide local loop back and remote loop back, each set of 8 T1/E1 ports loopback can be set independently, and by the DIP switch RA on front panel T1/E1 indicators can be controlled to indicate local or remote ports LOS and AIS status. The local and remote loop back definition is shown in the following diagram.



Rx → Tx can test T1/E1 connection cable, and Tx → Rx is used to test the whole circuit including then units at each end and the link between them.

Note: This equipment Ethernet electrical interface with the HP auto-MDIX feature that automatically detect network cable transmitting/receiving sequence and then adapting, both of MDI and MDI-X Ethernet interface, both crossover cable or straight cable can be used. Uplink interface connect with the Ethernet interface of wireless bridge we need to use straight cable.

Warning: When connecting to a wireless LAN bridge, the uplink Ethernet cable often connects to the outdoor unit, posing danger to lightning strikes that can seriously damage the equipment. To protect the equipment as well as people, surge protection devices with good earth connection is strongly recommended. Poor earth connection may also hinder the operation of the Ethernet port, causing severe packet losses.

Ethernet/fiber optic connection

RLH-TG Mux provides 5 standard RJ45 Ethernet interfaces and an SFP optical transceiver interface for connection with the transmission network, such as wireless Ethernet bridge interface, or access to a local Ethernet port, such as switch and so on. Any Ethernet electrical interface can be used for Web Server or SNMP management and device software and hardware upgrades.

The Ethernet optical interface uses SFP integrated optical modules. Dual fiber transceivers are marked with → for the optical signal input and with ← for the optical signal output. When connecting optical fiber to the transceiver, roll the fiber connections by attaching the Tx connector from on end to the Rx connector on the far end. Single fiber bi-directional transceivers are provided in pairs identified as C side or S side.

Keep the SFP protection plug and optical optical fiber caps in place until installed to prevent contamination.

Note: Fiber cable should always be routed loosely avoiding tight bends. Patch cord bend radius should be no less than 50mm. The optical connector should not be pulling directly on the transceiver.

5. Troubleshooting

This section describes common mistakes and faults that may occur during installation and maintenance.

E1/T1 Alarm LEDs on

There are two groups of LEDs, PKT LOS and LOS for T1/E1 alarms LEDs.

When T1/E1 LOS LED is on, loss of T1/E1 signal fault is detected by RLH-TG Mux. Possible causes include:

- The downstream equipment such as telephone exchange or PCM terminal is powered off.
- The T1/E1 cable connection looses or broken.

E1/T1 LOS LED blinks when respective input T1/E1 signal is AIS, i.e. the content of T1/E1 data is all 1's. Such alarm indicates fault conditions on the part of the downstream equipment.

E1/T1 LOS site is controlled by Dip Switch RA state. When RA Dip Switch ON, the red LEDs indicate remote T1/E1 LOS state. When RA Dip Switch OFF, the red LEDs indicate local T1/E1 LOS state.

The T1/E1 PKT LOS lights are packet loss indicator, On for Ethernet packet loss, Blink for T1/E1 Packet Loss, Off for Normal.

Lnk/Act LED off

Lnk/Act LED off means the corresponding Ethernet link is not working. Check the Ethernet cable connection, and the status of the device on the other end of the cable.

Ready LED does not blink

After power on, the Ready LED should start to blink. If not, try switching power ON and OFF. If this error persists, call for support.

Cannot set up T1/E1channel

Same LAN domain

When two RLH-TG Mux's are within the same Ethernet broadcast domain, try following.

- Check if the transmission network is on.
- Check that the network will pass broadcast packets. For a network that suppresses broadcast packets, as some of the wireless LAN bridges do, disable ARP and manually setup local and remote MAC's.
- Check that there is no MAC address conflict on the LAN.
- Check that the transmission network has enough bandwidth (more than 2.5Mbps duplex).

Different LAN domain

When two RLH-TG Mux's are in different Ethernet broadcast domains, IP headers must be used, and packets will be routed by a gateway router, try following:

- Check if the default gateway IP is defined correctly.
- Check if the local and remote IP is set correctly.
- Check for any conflicts in IP or MAC addresses.
- Make sure the transmission network has enough bandwidth.

Downstream reporting slips

Check if the downstream equipment has correct clock mode. At least one of them must be clock master. Set the RLH-TG Mux on master side to loop back timing.

If the downstream equipment on both sides is not synchronized, slips are not avoidable.

At the transition time after power on or reapplying the T1/E1signal, slips and errors are acceptable. Such transition may take several minutes.

If trouble persists, replace the unit and retest. If technical assistance is required, contact the RLH Industries, inc. technical support department:

800-877-1672 (6 am to 6 pm- PST),
or call our 24/7 Technical/Customer Service: (714) 366-2503 or (714) 457-5740

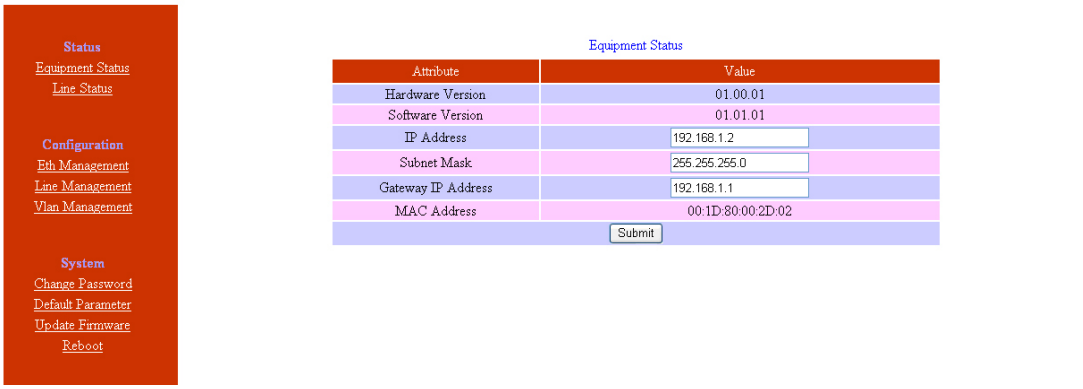
6. Web Manager

Both Web Server and SNMP management are supported through any one of two user data ports of RLH-TG Mux.

The management has three sections: Status, Configuration and System. User name and password are required to enter the sections of Line Test Configuration and system. Both the default user name and password are “admin”. Customers can modify the user name and password in the System section.

Show current status menu

After input the IP address, status information of RLH-TG Mux will be displayed such as hardware version, software version, IP address, subnet mask, gateway address and MAC address. IP address, subnet mask and gateway address could be changed manually, but hardware/software version and MAC address only could be inquired but not changed.



Status Menu

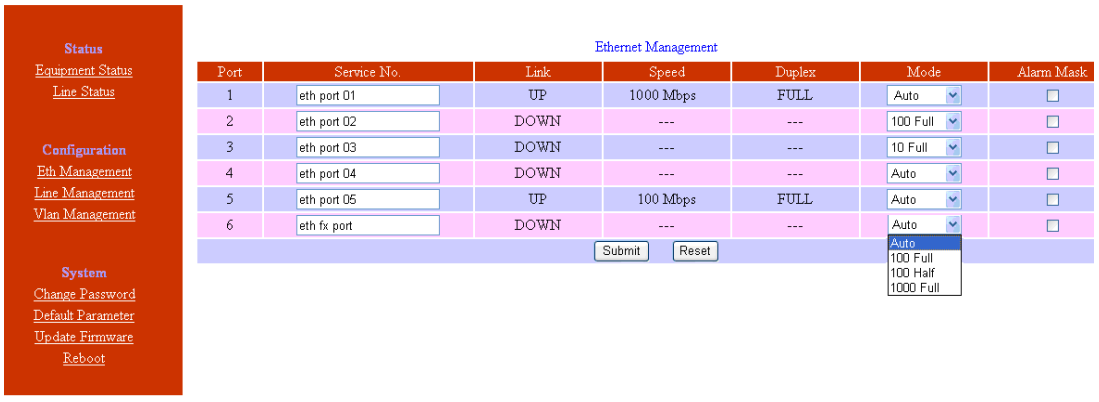
Selecting **Line Status** will bring line status interface, including current T1/E1 signal LOS, AIS alarm, loopback setting state and power failure indication. This alarm information could be masked in **Alarm Mask**. If the mask is set, corresponding alarms in LED indicators and SNMP management will be masked. At the same time, E1/T1 loopback settings state will be displayed. E1/T1 loopback could be used for line testing as described in Section 4, T1/E1 Connections. E1/T1 loopback setting only submit will valid, but loopback settings will not be saved when the equipment is rebooted. Each channel of E1/T1 will return to non-loopback state. Refer to the following screen.

T1/E1 Line Status Information

Configuration

Service configuration and parameters

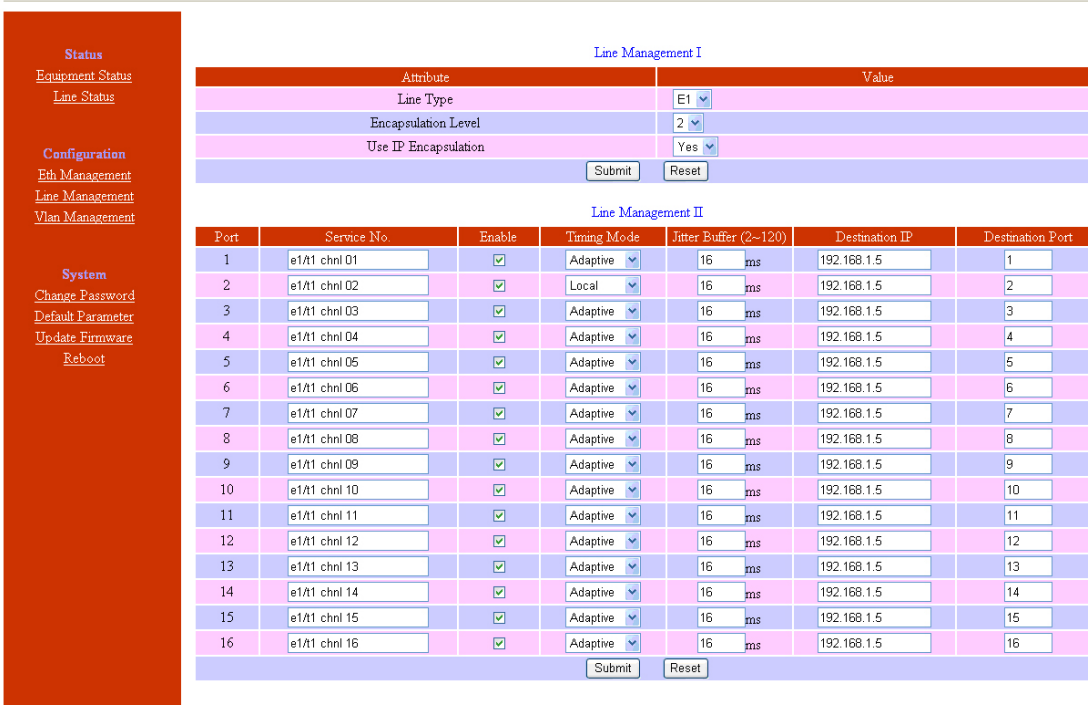
This section includes VLAN management, Ethernet Management and Line Management. Every section has many parameters setting.



Ethernet Management Table 5.3-3 Ethernet management parameters

Ethernet management parameters

Parameters		Options	Description
Ethernet Port Status	Port		6 Ethernet Ports Numbers
Status	Service Number		Ethernet service No.: support at most 20 capital/small letters, digit and part special character input. Chinese character support 2 numbers (does not support some special characters, as " / "、 " \ " input.
	Link		Link: indicate current Ethernet link (Up/Down)
	Speed		Speed 10/100/1000Mbps: indicate current Ethernet port speed
	Duplex		Duplex: indicate current Ethernet work mode (half/full)
	Mode	Auto 1000M full 100M full 100M half 10M full 10M half	6 Ethernet ports work mode configuration: Adaptive (Default) 1000M full 100M full 100M half 10M full 10M half Electrical interface work modes have Auto, 100M full, 100M half, 10M full and10M half. Optical interface work modes have Auto, 1000M full, 100M full and 100M half.
	Alarm Mask		Set Ethernet interface alarm mask

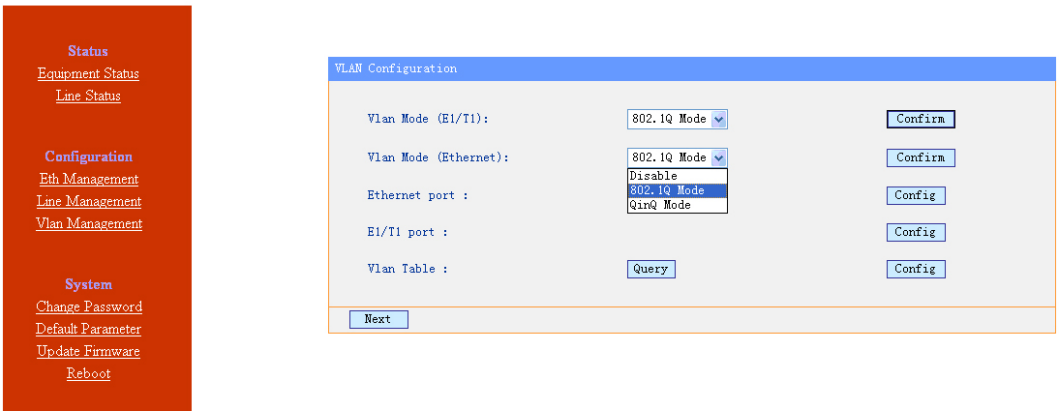

Status
Equipment Status
Line Status
Configuration
Eth Management
Line Management
Vlan Management
System
Change Password
Default Parameter
Update Firmware
Reboot
Line Management I
Attribute
Value
Line Type
E1
Encapsulation Level
2
Use IP Encapsulation
Yes
Submit
Reset
Line Management II
Port
Service No.
Enable
Timing Mode
Jitter Buffer (2~120)
Destination IP
Destination Port
1 e1/1 chnl 01 Adaptive 16 ms 192.168.1.5 1
2 e1/1 chnl 02 Local 16 ms 192.168.1.5 2
3 e1/1 chnl 03 Adaptive 16 ms 192.168.1.5 3
4 e1/1 chnl 04 Adaptive 16 ms 192.168.1.5 4
5 e1/1 chnl 05 Adaptive 16 ms 192.168.1.5 5
6 e1/1 chnl 06 Adaptive 16 ms 192.168.1.5 6
7 e1/1 chnl 07 Adaptive 16 ms 192.168.1.5 7
8 e1/1 chnl 08 Adaptive 16 ms 192.168.1.5 8
9 e1/1 chnl 09 Adaptive 16 ms 192.168.1.5 9
10 e1/1 chnl 10 Adaptive 16 ms 192.168.1.5 10
11 e1/1 chnl 11 Adaptive 16 ms 192.168.1.5 11
12 e1/1 chnl 12 Adaptive 16 ms 192.168.1.5 12
13 e1/1 chnl 13 Adaptive 16 ms 192.168.1.5 13
14 e1/1 chnl 14 Adaptive 16 ms 192.168.1.5 14
15 e1/1 chnl 15 Adaptive 16 ms 192.168.1.5 15
16 e1/1 chnl 16 Adaptive 16 ms 192.168.1.5 16
Submit
Reset

E1/T1 line management interface

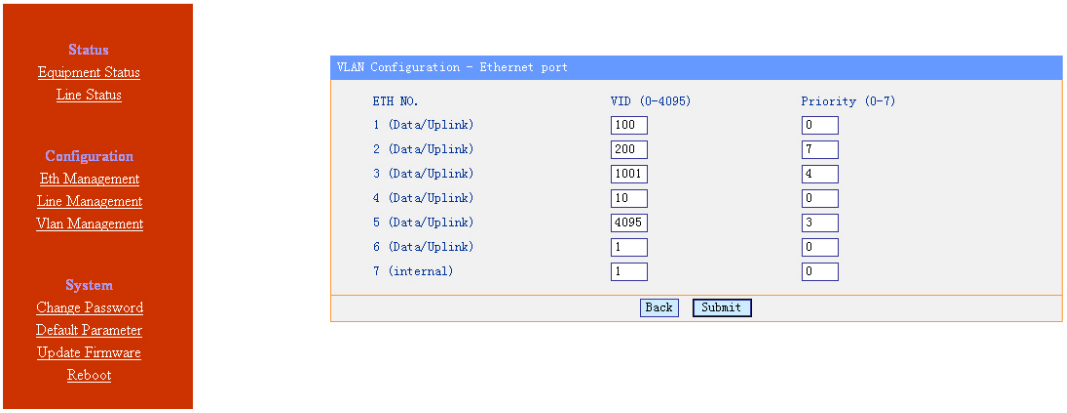
E1/T1 service management parameters setting are given below.

E1/T1 service management parameters

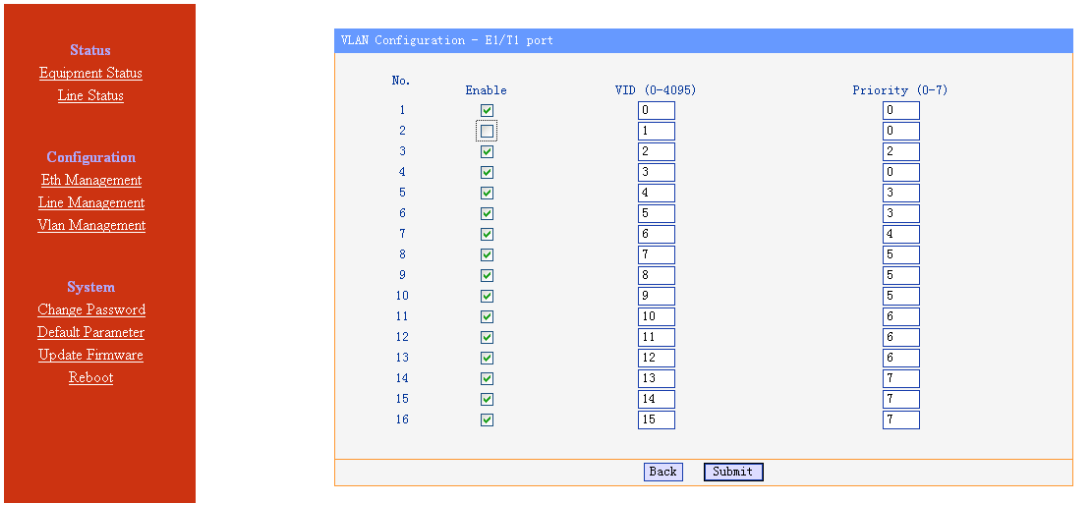
Parameters		Options	Description
T1/E1 Management	T1/E1	E1	E1 or T1 selected for all 16 channels of E1/T1 Default: E1
		T1	
	Encapsulation Level	1 ~ 5	E1 data size encapsulated in E1/T1, N=1~5 optional, corresponding to 256×N byte(E1).The bigger the packet is the more data each packet encapsulated, the lower overhead it has. Bandwidth efficiency will be raised and delay will be increased. Default :2
	Use IP Encapsulation	Yes	(Default) Yes: IP encapsulation, source and destination IP address should be set. Could pass router, Bandwidth efficiency will be reduced. No: do not use IP encapsulation, can not pass router, high bandwidth efficiency.
		No	
	Port		16 E1/T1 ports
	Service No.		E1/T1 service No.: Supports max. 20 upper/lowercase letters, digit and some special character inputs. Does not support some special characters such as "/" and "\".
	Enable		Enables the channel of E1/T1. Default: Enable
	Destination IP		Remote end IP address: 4 E1 line IP addresses can be set separately. Default 192.168.1.3
	Timing Mode	Adaptive	Adaptive mode: (Default) T1/E1 timing from remote T1/E1 stream. Loop back mode:T1/E1 timing from local E1 stream Local mode: E1/T1 timing from internal clock
		Loop back	
		Local	
	Jitter Buffer	2~120ms	Jitter absorption buffer: Used to buffer the receiving packets. Incoming packets are buffered to eliminate jitter. Range: 2~120ms Default: 16ms
	Destination IP		Each E1/T1 connected equipment IP address, could be set respectively. Default:192.168.1.3
	From remote port		Select corresponding relation of local T1/E1 ports to remote T1/E1 port service.



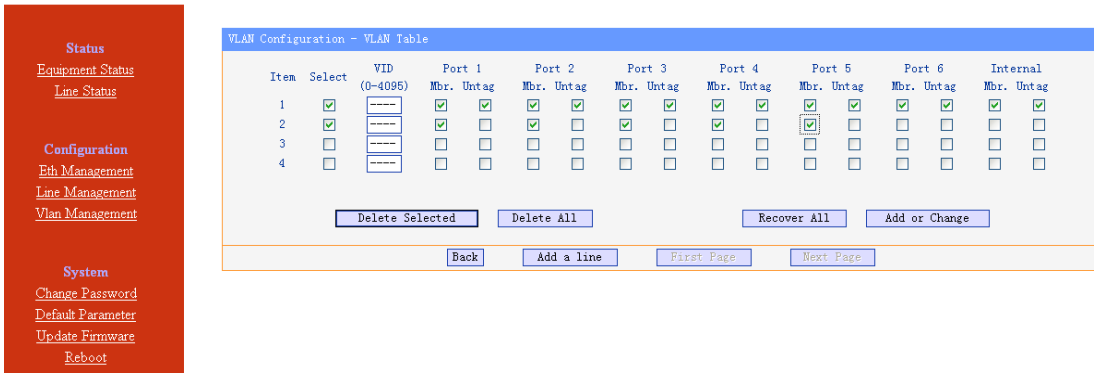
VLAN management interface (1) –VLAN configuration



VLAN management interface (2)- Ethernet port configuration



VLAN management interface (3)- E1/T1 port configuration



VLAN management interface(4)- VLAN table

VLAN management interface (5)-VLAN configuration confirm (click NEXT to enter)

VLAN management

Parameters		Selections	Description
VLAN Management	T1/E1 VLAN Configuration	Enable VLAN	Yes: With VLAN tag, support the VLAN network with priority to guarantee T1/E1 QoS. Default: No; no VLAN tag
		Priority	Define user priority, using 8 levels (0-7). Higher numbers have higher priorities. Default: 5
		Van ID	VLAN identification section, supports 4096 VLAN identifications. Range (0-4095). Default: 2662
	Local Data VLAN Configuration	Data2 Data1/ monitor	Add VLAN tag in local Ethernet service packet, the selection is as T1/E1 VLAN Configuration Default: disable VLAN, priority 0, VLAN ID:1

VLAN Management parameters

Parameters		Options	Description
VLAN Management	VLAN Mode (E1/T1)	802.1Q	802.1Q add VLAN tag on Ethernet frame. Q in Q add operators VLAN (S-Tag) in 802.1Q. Realizing VLAN stack. Suitable for the network with VLAN Priority, ensuring E1/T1 QoS.
		Q in Q	
	Ethernet Port VLAN Configuration	Ethernet No.	Ethernet port number 1~7 1~6 is Data/Uplink port, 7 is internal trunk.
		VID	VLAN ID, support 4096 VLAN, ID, range (0-4095)
		Priority	Define customer priority, including 8 PRI degree (0-7). PRI is higher when this number is bigger.
	E1/T1 Port VLAN Configuration	No.	E1/T1 port number 1~16
		Enable	After turning off, customer could set E1/T1 VLAN VID and PRI; otherwise, E1/T1 VLAN VID and PRI will set as default port 7.
		VID	VLAN ID, support 4096 VLAN, ID, range (0-4095)
		Priority	Define customer priority, including 8 PRI degree(0-7), PRI is higher when this number is bigger.
	VLAN Table		VLAN table configuration, inquiry, add and delete. Select: when add VLAN group or VLAN members, property configuration changed, this should be set to off. VID: VLAN group ID, support 0-4095 Mbr.: VLAN group member, it will be VLAN member when turned off Untag: tagged/untagged, selecting off means untag
	Next		Ethernet VLAN way, Ethernet port VLAN and VLAN table configuration confirm.

Service configuration indication

- Bandwidth auto adaptation for E1/T1 depends on whether the connection of E1/T1 is enabled or disabled. It is suggested to disable E1/T1 channels when they are not used.
- The MAC address of RLH-TG Mux is fixed in the device. It is a unique, 12-hex MAC address, such as 80-80-80-80-80-80, that enables communication with other equipment. Since the RLH-TG Mux's MAC address is already fixed, there is not need to set it again. ARP is supported and the remote end MAC address can be obtained through auto-negotiation. Therefore it is unnecessary to set the MAC address for the remote end, but an IP address is needed.

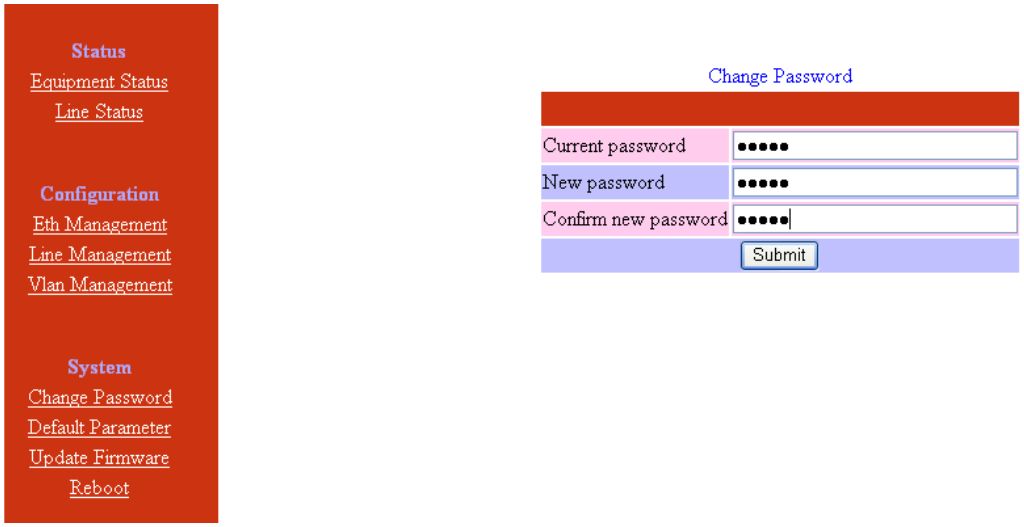
Note: Each device may have only one MAC address in the multicast zone

- To improve the E1/T1 data transmission service quality, the Ethernet transmission supports IEEE 802.1Q and 802.1p QoS standards. The RLH-TG Mux can set to add a VLAN tag with priority in the packet encapsulation process. According to 802.1Q/802.1p standards, the encapsulation overhead is bigger (4 bits are added in each Ethernet packet), but it also can be transmitted according to the priority level. If the network doesn't require 802.1p, there is no reason to set VLAN because it will increase bandwidth usage. In this case set VLAN to Disable.
- In order to avoid a management failure caused by configuring VLAN, do not set VLAN tag for the managed VLAN members (select off untag). Deselect internal trunk also. If internal trunk tag is needed, use the "remote first" rule and configure the remote equipment VLAN table first, then configure the VLAN table for the equipment connected using the management PC. If management failure is caused by configuring VLAN, set DIP switch 3 to OFF, which will disable VLAN.

Network configuration

The system configuration includes network configuration, change password, default parameters settings, save parameters, and reboot the equipment. The interfaces are shown as below:

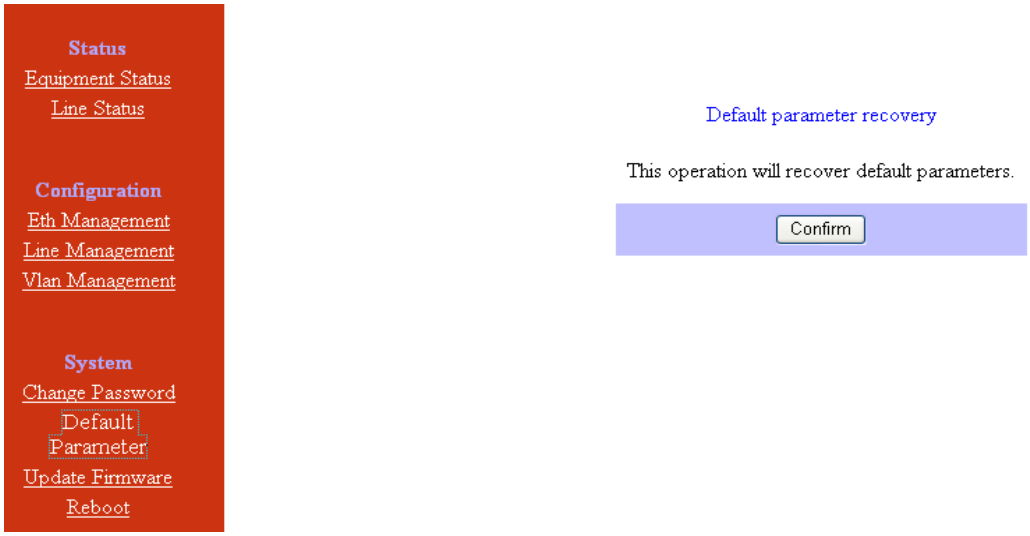
Change the password



Change the password

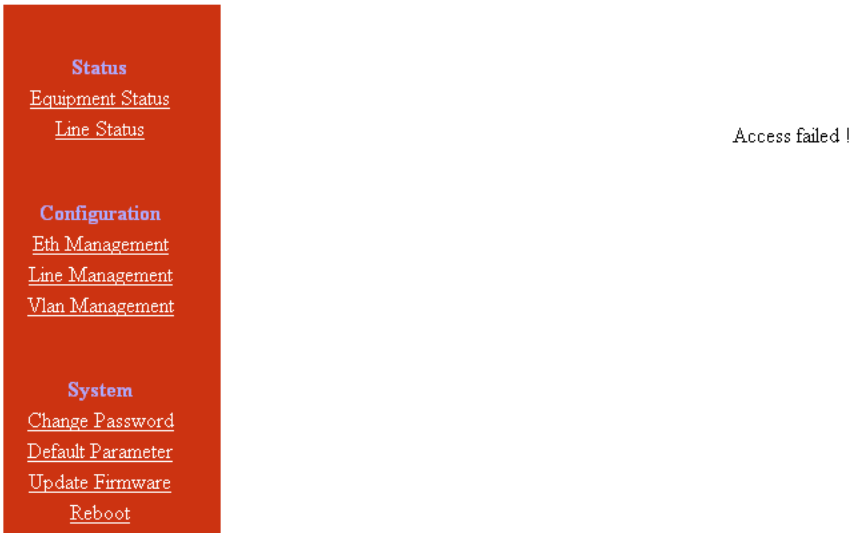
The change will be valid after confirming the setting.

Default parameter recovery



Default parameters recovery 1

After recovering default parameters, it will display access failed, as shown on the following screen. Restart the web server to complete the default parameters reset.



Default parameters recovery 2

Click Reboot to restart equipment. The default parameters will then be valid.

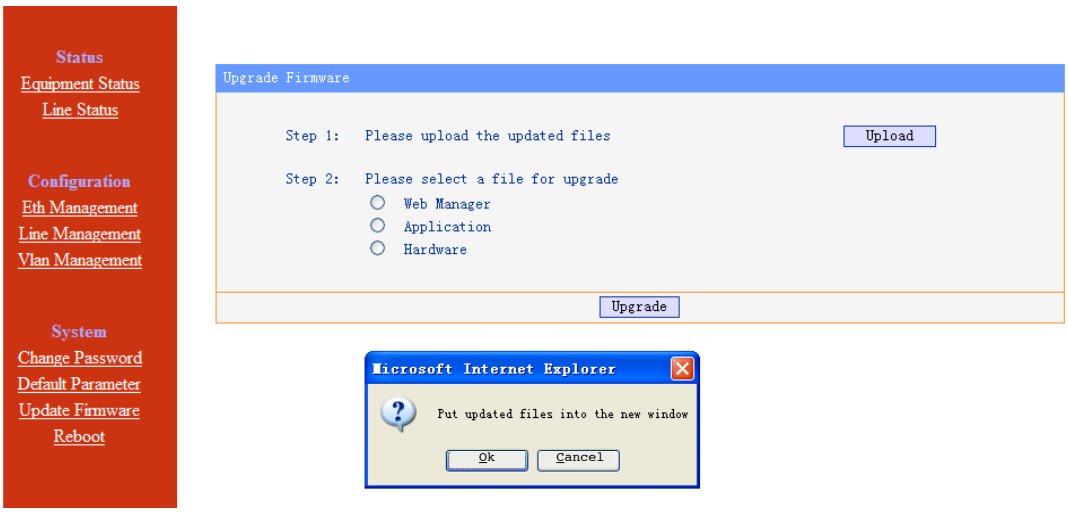
Webserver online upgrading

By webserver management, online upgrading requires IE 6.0 version or above. If using an older browser, use FTP for upgrading.

Introduction to webserver upgrade online operation

Step 1: click Upload to get the new program file.

Note: Hardware program file name is **H-Patch**, software program file name is **S-patch**. These cannot be changed.

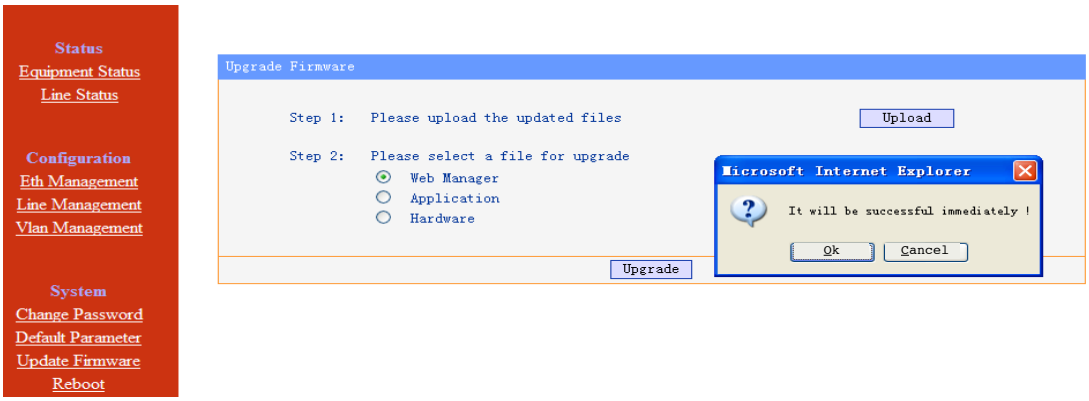


Upgrade online 1—upload new program

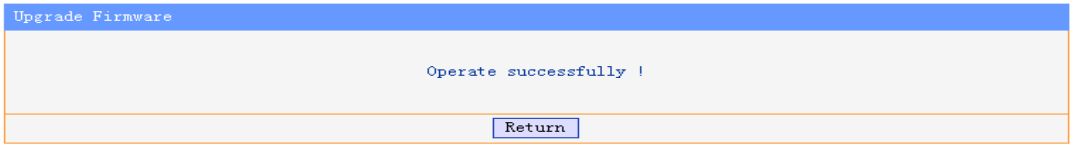
Step 2: select program type, click Upgrade to start.

Once the management software is upgraded successfully, restart the equipment. Either a warm boot (reboot) or cold boot may be used.

Upgrade Web management software

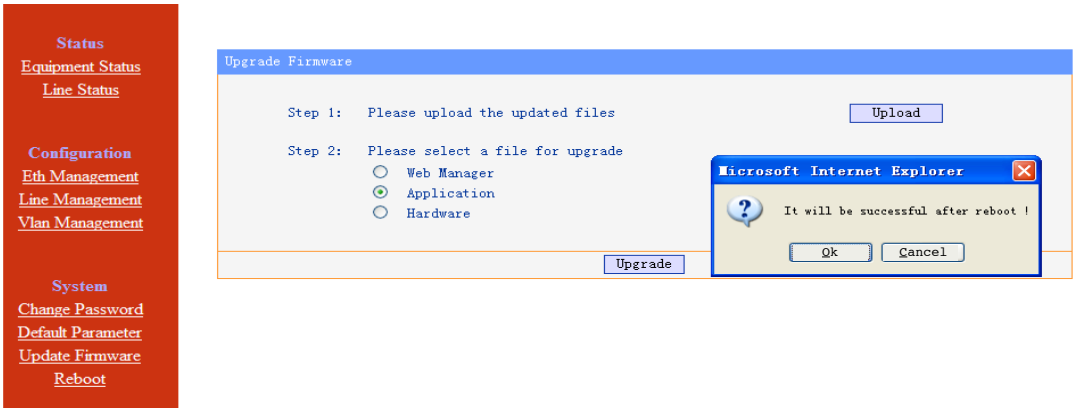


Upgrade online (1) – Select a file to upgrade



Upgrade online (2)—operate successfully

Upgrade the application software

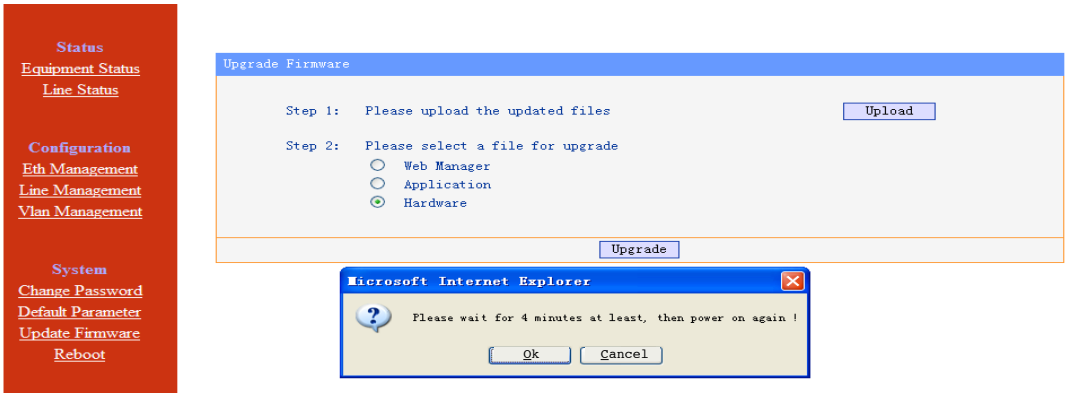


Upgrade online (3)—select an application software file

After the upgrade, the web browser will not be able to properly display the webpage. To refresh the web page, reboot the equipment using either a warm or cold boot. After rebooting the new software will be valid.

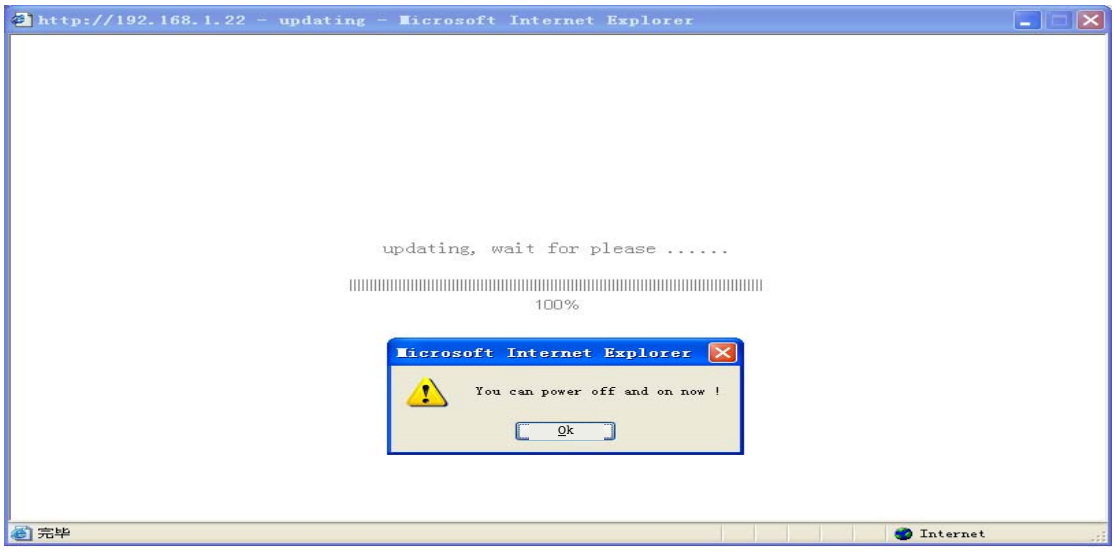
Upgrade hardware program

Upgrade hardware should be used carefully. It takes at least 4 minutes to upgrade, and If power fails during the upgrade, the equipment may not restart. In this case, you will need to reload the software via download cable, which will reset all service configurations. A cold boot is required after upgrading.



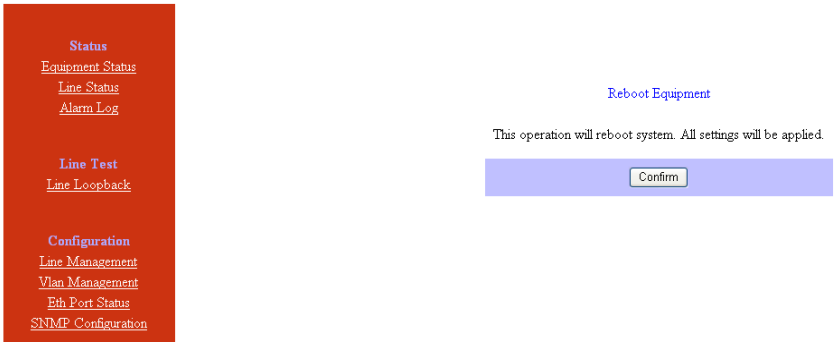
Upgrade online (4)—select a hardware program file

Select the Hardware option, it will display out a progress bar window. If no progress bar appears, check to see if your browser is set to block popup windows. If your browser cannot display the web page, wait at least 4 minutes and then switch off the equipment, otherwise the upgrade may be damaged and not restart.



Upgrade online (5)—installation is successful

System reboot



Reboot equipment

7. Ordering Information

16 Channel T1 over Ethernet Multiplexer System

RLH - TG - [X] [X] -1

- Manufacturer
- Product Designation
- Number of T1 Modules
  - 1 = Single T1 Module (8 T1 Channels)
  - 2 = Dual T1 Modules (16 T1 Channels)
  - 3 = Single E1 Module (8 E1 Channels)
  - 4 = Dual E1 Modules (16 E1 Channels)
- Powering Option
  - A = Dual 115VAC Power Supplies
  - V = Dual 24~48VDC Power Supplies
  - C = 115VAC and 24~48VDC Power Supplies
- Model Designation

- Optical SFP transceivers are ordered separately, one SFP required per chassis.

SFP Optical Transceivers

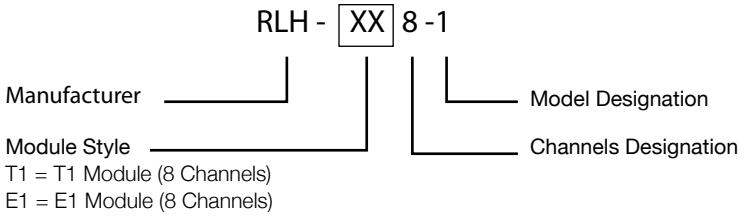
RLH - SFP - [XX] -1

- Manufacturer
- Product Designation
- Configuration Code
- Model Designation

Code	Multimode	Single Mode	Single Fiber Bi-Directional	Dual Fiber	SC Connector	LC Connector	0.5km/0.3mi. range	2km/1.25mi. range	20km/12.4 mi. range	40km/24.9 mi. range	60km/37 mi. range	80km/50 mi. range	C Side	S Side	Either Side
01	●		●		●			●					●		
02	●		●		●			●						●	
03	●			●		●	●								●
10		●	●		●			●					●		
11		●	●		●			●						●	
12		●	●		●				●				●		
13		●	●		●				●					●	
14		●	●		●					●			●		
15		●	●		●					●				●	
20		●	●			●			●				●		
21		●	●			●			●					●	
22		●	●			●				●			●		
23		●	●			●				●				●	
30		●		●		●			●						●
31		●		●		●					●				●
32		●		●		●						●			●

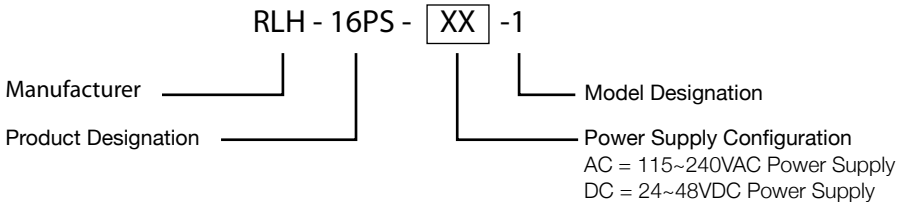
- Bidirectional single fiber SFP systems require a “C” unit and an “S” unit for a complete system
- Please contact your RLH sales representative for pricing and delivery information

Replacement/Spare T1 modules



- Each T1/E1 Module has 8 Channels
- Two T1/E1 modules may be installed into each chassis
- Please contact your RLH sales representative for pricing and delivery information

Replacement/Spare Power Supplies



- Each chassis holds two power supplies
- Please contact your RLH sales representative for pricing and delivery information

8. Specifications

Model	RLH-TG-XX-1	16 T1 5 GE electrical ports 1 GE SFP optical port
Interfaces	IP Ports	5 GE electrical ports and 1 GE SFP optical port Complies with IEEE 8802.3, 802.1Q, 802.1P Speed and duplexing auto-negotiating or manual selectable
	T1 Ports	16 T1 ports supported in 2 plug-in modules/B8ZS Complies with G.703 Impedance: 120Ω E1 or 75Ω T1
NM Port	Same as IP Ports	Web server and SNMP management supported
Power	Supply	Pluggable dual power supplies
		2 - DC or 2- AC or DC+AC combination
		18~75VDC@1A or 100~240VAC@1A
	Consumption	≤ 15W
Working Environment	Temperature	-4°F to +140°F (-20°C to +60°C)
	Relative Humidity	≤90% non-condensing
Dimensions	W x H x D	17.3in. x 1.7in. x 9.1 (1RU) (440mm x 44mm x 231mm)
	Mounting	EIA 19" 1RU Rack Mount, shelf or table mount.

9. Support

Warranty

RLH is recognized throughout the U.S. and offers the only **UNCONDITIONAL LIFETIME WARRANTY** in the telecommunications industry. We are very proud of our warranty which simply states that our Fiber Optic Link Assemblies are warranted to be free of defects in material and workmanship for the **LIFE OF THE PRODUCT**.

We can offer this warranty because:

- We believe our customers shouldn't have to incur additional costs due to failure or damage
- We engineer and manufacture our Fiber Optic Links in the USA, with total confidence in our quality
- We understand how safety and reliability impact the total cost of ownership
- We know that customer support extends beyond the initial sale, so **we stand behind our products**

RLH will replace any product, or part thereof, that fails **FOR ANY REASON**, provided the defective part is returned to RLH Freight prepaid. This warranty is **UNCONDITIONAL** and valid even when RLH Fiber Optic Link Assemblies have been abused or mishandled, where unauthorized repairs have been attempted or performed, or product has been damaged as a result of a natural disaster. Compare this warranty to our competitors and see how our warranty will reduce your costs and simplify your maintenance activities.

To make a warranty claim, or schedule repair or replacement of your RLH product, please contact us for an RMA number. You will be promptly assisted by one of our warranty specialists. All returns must have an RMA number before we can receive any items.

Technical Support

Normal technical support: (Mon - Fri 6am - 6pm PST)	Local (714) 532-1672 Toll Free (800) 877-1672 Toll Free (866) DO-FIBER
24/7 Technical support:	(714) 366-2503 (714) 457-5740

Contact Information

Corporate Headquarters:	RLH Industries, Inc. 936 N. Main Street Orange, CA 92867 USA
Phone:	Local (714) 532-1672 Toll Free (800) 877-1672 Toll Free (866) DO-FIBER
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Specifications subject to change without notice.